NOTICE

All drawings located at the end of the document.

Department of Energy

ROCKY FLATS FIELD OFFICE
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JAN 0 8 1998

98-DOE-03628

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DOE ORDER # 5400.1

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Rocky Flats Project
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Mr Steve Tarlton
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Dear Mr. Rehder and Mr Tarlton

The U. S. Department of Energy Rocky Flats Field Office is pleased to transmit to your organizations two copies of "Sampling and Analysis Plan for Groundwater Sampling and Well Installation in the Solar Ponds Plume Area" to review This plan outlines the groundwater sampling program that was described at our November meeting Seventy-two wells in the Solar Ponds Plume Area will be sampled and the samples analyzed for nitrate/nitrite and uranium isotopes These data will be used to determine the nature and extent of the Solar Ponds Plume in each of the identified stratigraphic units (alluvium, weathered bedrock, and competent bedrock). Of these 72 wells, 65 currently exist. The locations and installation of the seven new wells are described in this plan In addition to these wells, 19 additional wells (4 in North and South Walnut Creek drainages and 15 background wells) will be sampled and the samples analyzed for uranium isotopes only These data, in conjunction with the uranium data from the 72 wells, will be used to evaluate the amount of naturally-occurring uranium in the Solar Ponds Plume groundwater

These data analyses will support a final determination of the best alternative for remediation of the Solar Ponds Plume, which will be discussed in the Decision Document to be completed in September 1998 Due to critical timing for collection of this large number of groundwater samples, groundwater sampling activities have already begun Approximately 60 wells remain to be sampled We request comments on this Sampling and Analysis Plan within five working days of receipt of this letter, if possible

KAISER•HILL
COMPANY

RMRS Rocky Mountain Remediation Services LLC
protecting the environment

Sampling and Analysis Plan for Groundwater Sampling and Well Installation in the Solar Ponds Plume Area

RF/RMRS-97-136

December 29, 1997

Revision 0

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Prepared by:

Rocky Mountain Remediation Services, L.L.C.

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1 0 INTRODUCTION

The Solar Ponds Plume (SPP) is an area of groundwater contamination which extends from the Solar Evaporation Ponds (Solar Ponds), in the northeastern corner of the Industrial Area, to the northeast toward North Walnut Creek and to the southeast toward South Walnut Creek (Figures 1 and 2) The primary contaminants of concern are nitrate/nitrite and uranium isotopes ($U^{233\ 234\ 235}$ and U^{238}), however, other inorganic and organic compounds have also been identified above the Tier II Action Levels in some wells

Although there are many wells in this area and a large amount of water quality data has been collected over the years, particularly nitrate, all of the wells have never been sampled for the same analytical suite during one sampling event The purpose of this Sampling and Analysis Plan (SAP) is to define the groundwater sampling and well installation activities to be conducted for characterization of the groundwater contamination in the SPP area Installation of up to seven additional groundwater monitoring wells in three areas of the SPP is proposed to fill in missing data in the alluvium or weathered bedrock units or to replace previously-installed wells that have been destroyed A Geoprobe ™ will be used to install the new monitoring wells

The objective of this SAP is to describe the specific data needs of this groundwater sampling event, as well as the sampling and analysis requirements, data handling procedures, well construction criteria, and associated Quality Assurance/Quality Control (QA/QC) requirements for this project All work will be performed in accordance with the RMRS Quality Assurance Program Description (QAPD) (RMRS 1997) The SAP summarizes the existing data and describes the procedures to be used in installation of the monitoring wells and collection of the groundwater samples

1 1 Background

The Solar Evaporation Ponds (Solar Ponds) are located in the northeastern corner of the Protected Area The five ponds were used to store and evaporate radioactive process water from the 1950s to 1986 Cleanup activities began in 1985 to drain and remove sludges from the five ponds and the Building 788 Clarifier The intent was to process the sludges to produce "pondcrete" blocks, which would be shipped to the Nevada Test Site for disposal Difficulties in the pondcrete solidification process, as well as disposal of the pondcrete blocks (tests showed that the pondcrete contained hazardous constituents which rendered it a mixed waste),

resulted in cessation of shipments of pondcrete to NTS in 1990 Approximately 10,000 cubic yards of pondcrete remain at RFETS In 1993, the remaining sludges were collected via vacuum trucks and contained in 66 10,000-gallon capacity storage tanks These tanks are currently stored on the 750 Storage Pad Additional remediation activities to remove contaminated soils, equipment, and structures are proceeding In the Focus on 2006 plan for RFETS (Kaiser-Hill, 1997), capping was selected as the ultimate remediation for the Solar Ponds and vicinity, and is expected to be completed in Fiscal Year 2008

The Solar Ponds Plume, or SPP, emanates from the ponds The SPP is being evaluated separately from the Solar Ponds themselves The primary contaminants of the SPP are nitrate and uranium The plume extends northward from the Solar Ponds to North Walnut Creek and to the southeast, towards South Walnut Creek Volatile organic compounds (primarily trichloroethylene [TCE], tetrachloroethylene [PCE], carbon tetrachloride [CCL_4], 1,1-dichloroethylene [1,1-DCE], and chloroform) have been detected in wells located in the area of the western Solar Ponds and to the southeast of the Solar Ponds This VOC contamination is not thought to have originated at the Solar Ponds, but from source areas to the west and southeast Exceedances of the RFCA groundwater standards for several metals have also been detected

An Interceptor Trench System (ITS) was installed in 1971 and expanded in 1981 to prevent the SPP from reaching North Walnut Creek This system of trenches and drains traverses the hillside to the north of the Solar Ponds and collects both surface water infiltration and groundwater The ITS was installed in the unconsolidated alluvium and is not keyed into bedrock The ITS effectively dewaters the alluvium in this area, however, contaminated groundwater in the weathered bedrock directly below the alluvium may continue movement toward North Walnut Creek Since 1993, water collected by the ITS has been transferred to three modular storage tanks (MSTs), where it is stored prior to evaporation at Building 374 The cost of treatment at Building 374 is approximately $2 per gallon, approximately 2 to 3 million gallons of water are treated each year

1.2 Evaluation of Remedial Alternatives for SPP

In 1997, RMRS undertook a study to evaluate alternatives for management and treatment of the water collected by the ITS (*Solar Ponds Plume Remediation and Interceptor Trench System Water Treatment Study,* RMRS/RTG, September 1997) The objective of the study was to determine a permanent remedy for the SPP Eleven alternatives were evaluated and four alternatives were retained for further study

1) Managed release of ITS water to Pond A-4, 2) Treatment of ITS water at Building 995, 3) Phytoremediation, and 4) Enhanced Evaporation of ITS water at the MSTs Enhanced Evaporation has been eliminated from further study, due to concerns of windblown dispersion during the spraying operation used for the evaporation of the ITS water

The nature and extent of the SPP has not been thoroughly defined, the sampling event described in this SAP will provide the data to define the SPP Another aspect of further study necessary for final evaluation of the retained alternatives is a refined conceptual hydrogeological model and a site groundwater flow model These models can be used to predict the concentrations of nitrate, uranium, or other contaminants in the groundwater that will discharge to North Walnut Creek once RFETS has been closed and the ITS is no longer used to collect the SPP water The current and planned field activities (discussed in Sections 2 and 3 of this SAP) will collect the data necessary to complete the conceptual hydrogeological model and site groundwater flow model, as well as evaluate the three retained remedial alternatives

1.3 Site Conceptual Model

The Solar Ponds are located on level ground in the northeastern portion of the Protected Area The subsurface geology beneath the SPP consists of surficial deposits underlain by weathered/fractured bedrock and competent bedrock (claystone)

1 3.1 Surficial Deposits (Alluvium)

The surficial deposits in the Solar Ponds and SPP areas consist of Rocky Flats Alluvium, landslide deposits, colluvium, valley-fill alluvium, and artificial fill The Rocky Flats Alluvium, composed of clay, silt, sand, and heterogeneous pebbles, cobbles, and boulders, underlies the Solar Ponds Artificial fill and colluvium are found together in the ITS area and to the southeast of the Solar Ponds Valley fill alluvium, composed of clay, silt, sand, and pebbly sand with silty and cobbly gravel lenses, is found in the Walnut Creek drainages Hereafter, the surficial deposits will be referred to as "alluvium "

The alluvium thickness ranges from 1 to 22 5 feet in the vicinity of the Solar Ponds and the SPP The thickest areas of alluvium are found to the northeast (near well 46393) and southeast (near well P219489) of the Solar Ponds (ERM, 2/96) Bedrock unconformably underlies the surficial deposits and consists of weathered

claystone and minor sandstones of the Cretaceous Arapahoe and Laramie Formations (DOE 1995, DOE 1996b)

Ground water flow enters the Solar Ponds area from the west-southwest in the alluvium and weathered bedrock Groundwater flows eastward beneath the Solar Ponds and then diverges to the north-northeast toward North Walnut Creek and to the east-southeast toward South Walnut Creek This divergence in groundwater flow is caused by an east-west trending bedrock high beneath the Solar Ponds and natural topographic breaks in these directions (ERM, 2/96) The groundwater flow path is very complex due to the varying thicknesses of the alluvium and weathered bedrock units and the highly variable primary and secondary permeabilities of the two units The combination of the varying thickness of the alluvium and seasonal water table fluctuations result in large areas of the alluvium becoming unsaturated The lateral groundwater flow direction in the competent bedrock is not well defined The hydraulic gradient is downward between the alluvium and weathered bedrock in the vicinity of the Solar Ponds due to infiltration of rainfall at the ponds, but appears to be upward in the vicinity of North and South Walnut Creeks, based on limited data (ERM, 2/96)

The hydraulic conductivity of the alluvium ranges from 10^{8} to 10^{2} cm/sec (3 0 x 10^{-4} to 3 0 x 10^{2} feet/day), with the higher values attributed to valley fill and alluvium, and the lower values attributed to the Rocky Flats Alluvium (EG&G, 1994) The typical hydraulic conductivity for Rocky Flats Alluvium was on the order of 10^{5} cm/sec (3 0 x 10^{1} feet/day)

1.3.2 Weathered Bedrock

The "weathered bedrock" consists predominantly of the weathered or fractured portion of the uppermost claystone bedrock and some lenticular sandstone deposits (where they are in hydraulic connection with the alluvium or weathered bedrock) Groundwater flow in the weathered bedrock mimics that in the alluvium The hydraulic conductivity of the weathered bedrock is one to two orders of magnitude less than that in the alluvium However, localized fracturing and the presence of the sandstone lenses may provide preferential groundwater flow pathways for contaminant migration between the stratigraphic units

1 3.3 Competent Bedrock

The competent bedrock at RFETS consists of claystone which is relatively unfractured and generally contains little water The lateral ground water flow direction in the competent bedrock is not well defined, as it is difficult to install wells in which water levels can be measured The hydraulic conductivity of the competent bedrock is one to two orders of magnitude less than that of the weathered bedrock

1 3.4 Groundwater Recharge in the SPP Area

Groundwater recharge in the SPP area comes primarily from runoff from the Protected Area, particularly the Building 779 area and from water used for dust suppression for the Solar Ponds RMRS/RTG estimated that approximately 35 % (or about 1 million gallons) of the water collected by the ITS resulted from infiltration of surface runoff from Building 779

2 0 PROJECT AND DATA QUALITY OBJECTIVES

The objective of the groundwater sampling event outlined in this SAP is to determine the nature and extent of the SPP and to evaluate whether or not the uranium present in the groundwater is naturally occurring To fully characterize the SPP, 65 existing wells will be sampled and up to seven new groundwater monitoring wells will be installed and sampled All of these wells will be sampled for nitrate/nitrite and uranium isotopes, 11 will also be analyzed for volatile organic compounds (VOCs) In addition, 19 existing wells (4 in North Walnut Creek drainage and 15 background wells) will be sampled for uranium isotopes only The wells will be sampled during one sampling event and will be completed in early February 1998 The new groundwater monitoring wells will be installed and sampled as soon as this SAP is approved

Once the results of this initial sampling event have been reviewed, six to ten wells will be selected for two more quarters of sampling for nitrate and uranium isotopes These sample results will be used to monitor any seasonal changes in water quality which occur in the SPP Water levels from all 65 wells(or 72wells if the new wells have been installed) will be measured in one event in January 1998, and water levels will be measured at a subset (15 wells) of these wells monthly through June 1998

RMRS is currently reevaluating the existing background uranium isotope data to determine the amount of the various uranium isotopes detected in background groundwater that are naturally occurring and the amount that

may have resulted from site activities The data collected during this sampling event will aid in this reevaluation

The wells that would be sampled are shown on Figures 1 and 2 and described on Table 1 Data requirements to support this project were developed using criteria established in *Guidance for the Data Quality Objective Process*, EPA QA/G-4 (EPA 1994) The data gaps, study boundaries, and decisions are described below

Groundwater action levels are specified in RFCA (DOE 1996a) and are intended to prevent contamination of surface water by applying action levels to groundwater which are protective of surface water and ecological resources These groundwater action levels are based on maximum contaminant levels (MCLs) and applied using a two-tiered approach Tier I action levels are 100 x MCLs and are designed to identify sources of groundwater contamination that should be addressed through accelerated actions Tier II action levels consist of MCLs and are designed to prevent surface water from exceeding surface water standards by triggering groundwater management actions when necessary

The groundwater sampling events outlined in this SAP focus on the Solar Ponds, SPP, North Walnut Creek and South Walnut Creek areas The RMRS sampling crew visited each well in the SPP area to determine if it still existed and if it contained enough water for collection of nitrate and uranium sample aliquots Based on this information and a review of the screened intervals of the wells, 65 wells within the SPP were selected for sampling in the initial sampling event

In order to have a complete view of the nature and extent of the SPP in each stratigraphic unit (alluvium, weathered bedrock, and bedrock), installation of additional wells is necessary in areas where wells are not present or have been destroyed New monitoring wells will be installed in four areas south and southeast of the MSTs (Areas 1 and 2, respectively) and to the southeast of the Solar Ponds (Areas 3 and 4) The new wells are intended to monitor specific zones within the Upper Hydrostratigraphic Unit (UHSU) (alluvium or weathered bedrock) and will help to identify any stratification of contaminants within the UHSU See Figures 1 and 2 for locations of existing wells to be sampled and the Areas where the proposed new monitoring wells will be installed Once the results of this sampling event are reviewed, six to ten wells will be selected for two additional quarters of sampling The data from these sampling events will more clearly define the nature

and extent of the Solar Ponds Plume and allow evaluation of the necessity of a groundwater management action for the SPP

Table 1 lists the wells to be sampled, the unit screened by the wells, and the analyses requested for each well for the initial sampling event Table 2 presents the analytical methods and sampling requirements for the initial sampling event The initial sampling event will include the following parameters

- 65 existing wells and the seven new wells will be analyzed for nitrate/nitrite and uranium isotopes because these are the primary contaminants of the SPP
- 19 additional wells (4 in North and South Walnut Creek drainages and 15 background wells) will be sampled for uranium isotopes only
- 11 wells within the SPP will be sampled for volatile organic compounds (VOCs) to evaluate the extent of the VOC plumes which originate outside of the Solar Ponds area

Table 1. Wells To Be Sampled In November 1997 - February 1998

	Geologic Unit	Well #	Nitrate/Nitrite and Uranium	Uranium Only	VOCs	Comments
1	Alluvium	05293	Y	---	---	
2	Alluvium	2686	Y	---	---	
3	Alluvium	3887	Y	---	---	
4	Alluvium	05193	Y	---	---	
5	Alluvium	P209789	Y	---	---	
6	Alluvium	P218389*	Y	---	---	
7	Alluvium	P207889	Y	---	---	
8	Alluvium	05093	Y	---	---	
9	Alluvium	5687	Y	---	---	
10	Alluvium	2286	Y	---	---	
11	Alluvium	45793	Y	---	Y	
12	Alluvium	41193	Y	---	---	
13	Alluvium	46293	Y	---	---	
14	Alluvium	45093	Y	---	---	
15	Alluvium	45393	Y	---	---	
16	Alluvium	46393	Y	---	---	
17	Alluvium	1386*	Y	---	---	
18	Alluvium	1586	Y	---	---	
19	Alluvium	1786*	Y	---	---	

Table 1. Continued

	Geologic Unit	Well #	Nitrate/Nitrite and Uranium	Uranium Only	VOCs	Comments
20	Alluvium	29795	Y	---	---	
21	Alluvium	B208589	Y	---	---	
22	Alluvium	B210489*	Y	---	---	
23	Alluvium	B208789*	Y	---	---	
24	Alluvium	10594	---	Y	---	North Walnut Creek
25	Alluvium	10694	---	Y	---	North Walnut Creek
26	Alluvium	75292	---	Y	---	South Walnut Creek
27	Alluvium	75992 or 3686	---	Y	---	South Walnut Creek
28	Alluvium	B205589	---	Y	---	Background
29	Alluvium	B200789	---	Y	---	Background
30	Alluvium	B200589	---	Y	---	Background
31	Alluvium	B202589	---	Y	---	Background
32	Alluvium	B102289	---	Y	---	Background
33	Alluvium	B302789	---	Y	---	Background
34	Alluvium	10294	---	Y	---	Background
35	Alluvium	5386	---	Y	---	Background
36	Alluvium	5586	---	Y	---	Background
37	Alluvium	Area 2, W1	Y	---	---	Area 2, New Well
38	Alluvium/Bedrock	45893	Y	---	Y	
39	Alluvium/Bedrock	45993	Y	---	Y	
40	Alluvium/Bedrock	41993	Y	---	Y	
41	Alluvium/Bedrock	42993	Y	---	---	
42	Alluvium/Bedrock	43593	Y	---	---	
43	Alluvium/Bedrock	43893	Y	---	Y	
44	Alluvium/Bedrock	43993	Y	---	Y	
45	Alluvium/Bedrock	42393	Y	---	Y	
46	Alluvium/Bedrock	41693	Y	---	---	
47	Alluvium/Bedrock	43293	Y	---	---	
48	Weathered Bedrock	28295	Y	---	---	
49	Weathered Bedrock	B208689	Y	---	---	
50	Weathered Bedrock	B210389	Y	---	---	
51	Weathered Bedrock	P210089	Y	---	---	
52	Weathered Bedrock	30595	Y	---	Y	
53	Weathered Bedrock	30695	Y	---	Y	
54	Weathered Bedrock	29395	Y	---	Y	
55	Weathered Bedrock	45693	Y	---	Y	
56	Weathered Bedrock	46193	Y	---	---	
57	Weathered Bedrock	P209889	Y	---	---	

Table 1 Continued

	Geologic Unit	Well #	Nitrate/Nitrite and Uranium	Uranium Only	VOCs	Comments
58	Weathered Bedrock	26995	Y	---	---	
59	Weathered Bedrock	P209589	Y	---	---	
60	Weathered Bedrock	3086	Y	---	---	
61	Weathered Bedrock	P208989	Y	---	---	
62	Weathered Bedrock	P209489*	Y	---	---	
63	Weathered Bedrock	P209189	Y	---	---	
64	Weathered Bedrock	P210189	Y	---	---	
65	Weathered Bedrock	P209089	Y	---	---	
66	Weathered Bedrock	05393	Y	---	---	
67	Weathered Bedrock	P207989	Y	---	---	
68	Weathered Bedrock	76292	Y	---	---	
69	Weathered Bedrock	P219589	Y	---	---	
70	Weathered Bedrock	23995	Y	---	---	
71	Weathered Bedrock	02691	Y	---	---	
72	Weathered Bedrock	Area 1, W1	Y	---	---	Area 1, New Well
73	Weathered Bedrock	Area 3, W1	Y	---	---	Area 3, New Well
74	Weathered Bedrock	Area 3, W2	Y	---	---	Area 3, New Well
75	Weathered Bedrock	Area 3, W3	Y	---	---	Area 3, New Well
76	Weathered Bedrock	Area 3, W4	Y	---	---	Area 3, New Well
77	Weathered Bedrock	Area 3, W5	Y	---	---	Area 3, New Well
78	Weathered Bedrock	B203189	---	Y	---	Background
79	Weathered Bedrock	B305389	---	Y	---	Background
80	Weathered Bedrock	B201589	---	Y	---	Background
81	Weathered Bedrock	B203489	---	Y	---	Background
82	Weathered Bedrock	B405489	---	Y	---	Background
83	Bedrock	B304989	---	Y	---	Background
84	Bedrock	P208889	Y	---	---	
85	Bedrock	3987	Y	---	---	
86	Bedrock	1486	Y	---	---	
87	Bedrock	3286	Y	---	---	
88	Bedrock	2386	Y	---	---	
89	Bedrock	2586	Y	---	---	
90	Bedrock	2786	Y	---	---	
91	Bedrock	1686	Y	---	---	

* RFCA Well

Table 2 Analytical Sampling Requirements

Analytical Method	Number of Samples	Number of QC Samples	Total Number of Samples	Containers, Preservatives, Holding Times
EPA Method 524 2 Volatile Organic Compounds	11	1 duplicate 1 rinsate 2 trip blanks	15	Three 40 ml teflon-lined VOA vials with septum lids, HCl to pH < 2 and 4° C, 14 days
EPA Method 353 2 Nitrate/Nitrite as Nitrogen	72	4 duplicates 4 rinsates	80	250 ml in polyethylene jar, H_2SO_4 to pH<2, 4° C, 28 days
Alpha Spectroscopy Dissolved Uranium Isotopes	91	5 duplicates 5 rinsates	101	One 1-L glass bottle, 4°C, 6 months
Radiological Screening	91	0 duplicates	91	100 ml in poly jar, delivered to on-site lab next day

The wells to be sampled and the analytes to be requested in the additional two quarterly sampling events will be determined after review of the results of the initial sampling event

No samples will be analyzed for metals during this sampling event A thorough analysis of all of the metals data available for the SPP wells was conducted Metals data existed for 11 wells (1386, 1486, 1586, 1786, 76292, B208589, B208689, B210389, B210489, P209789, and P209889) which covered the Solar Ponds and SPP area The results of this analysis are summarized below

- No metals were detected above the Tier II action levels (MCLs) or background (mean plus two standard deviations or M2SD) for four wells (1486, 1786, B210389, and 76292)

- Thallium above the site background of 4 9 µg/L was sporadically detected in five wells (1586, B208589, B208689, P209789, and P209889), but there did not appear to be a trend of increasing concentrations at these wells, nor did adjacent wells have high thallium concentrations

- Cadmium above the Tier II level (5 µg/L) was detected at 1386 in 1992, however, the 1993 concentration was below the Tier II level and site background (4 25 µg/L) At B209889, cadmium concentrations in samples collected in 1991 and 1993 exceeded the Tier II level The cadmium concentration in the 1995 sample (3 8 µg/L) was below both the Tier II level and the M2SD

- Nickel above the Tier II level was detected in the November 1996 sample from 1386 Trend analysis of the nickel data for 1991 through 1996 shows that the data bounces up and down-every other sampling event, no trend is apparent High nickel concentrations were not observed in any other SPP wells

- Strontium above the Tier II level was detected fairly consistently at P209889 from 1991 through April 1994 However, strontium concentrations in samples collected from October 1994 through July 1995 were below the Tier II level Strontium above the Tier II level was not detected at any downgradient wells

- Lithium was consistently detected at concentrations above the MCL at both well B208689 and P209889 Both of these wells are in the center of the SPP and indicate that the lithium has moved with the groundwater in the weathered bedrock from the Solar Ponds to the North Walnut Creek area However, samples from the alluvial well adjacent to B208689 near North Walnut Creek (1786) showed no metals above the MCL Therefore, it does not appear that the lithium is entering the alluvium and the surface water of North Walnut Creek

Based on the above summary of data, there is no indication of a metals plume in the SPP groundwater which requires additional sampling to characterize The only metal of potential concern is lithium, and wells in the alluvium along North Walnut Creek downgradient of B208689 are part of the RFCA program and are monitored biannually (1786, B210489, and 1386) If lithium is detected above the Tier II level in these wells, sampling of additional wells for lithium may be required All of the metals data will be provided to the subcontractor who will be developing the site conceptual hydrogeologic model and the groundwater flow model to ensure that they are considered in all geochemical interpretations The lithium data, in addition to the nitrate/nitrite and uranium data, will be provided to the subcontractor evaluating the phytoremediation system

3 0 WELL INSTALLATION, SAMPLING AND ANALYSES

This SAP has been designed to collect the data necessary to define the SPP and allow selection and implementation of a groundwater control system, if the SPP hydrogeological analysis and groundwater flow model indicate that one is necessary A thorough definition of the SPP will require installation of up to seven

new wells in four areas of the SPP (Areas 1, 2, 3, and 4, as shown on Figure 2) Two wells are planned to be installed in the alluvium and five in the weathered bedrock, depending upon the saturated thickness in Areas Several of the wells may be installed in the Protected Area to the southeast of the Solar Ponds

The sampling requirements for the samples to be collected under this SAP are described in Table 2 and in the following sections Samples will be handled in accordance with FO 10 Receiving, Labeling, and Handling Environmental Material Containers, and FO 13 Containerization, Preserving, Handling and Shipping of Soil and Water Samples If conditions are encountered in the field which make the use of a procedure unsafe or inappropriate for the task at hand, the specified procedures may be modified or replaced as long as the modification or replacement procedure is justified and detailed in the field logbook, and the resulting data is comparable and adequate to meet the objectives of the project

3.1 Well Installation Using Geoprobe™

Each well location will be established using tape and compass, and marked with reference stakes or flags and a unique number for that location The well location number will be obtained from RFEDS (or the Soil Water Database) and correlated with sample analyses for that location These locations will be surveyed for location and elevation using GPS receivers operated in accordance with the equipment manuals (Ashtech 1993)

The Geoprobe™ will be used to advance the boreholes for well installation Core will be collected continuously in 2- to 5-foot increments from the surface to the depth required for proper screening of the well in the targeted stratigraphic unit, as determined by the on-site geologist For alluvial wells, total well depth will be approximately 2 feet into bedrock or weathered bedrock The on-site geologist will determine the depth of the weathered bedrock wells by identifying the water level in the weathered bedrock during borehole advancement and continuing to drill until a sufficient saturated thickness for well installation or competent bedrock is encountered Core samples will be collected continuously in 2- to 5-foot increments from the surface to total borehole depth The core will be monitored in accordance with FO 15 Photoionization Detectors and Flame Ionization Detectors, visually inspected for signs of contaminant staining, and then lithologically logged by the field geologist per GT 01 Logging Alluvial and Bedrock Material No soil samples will be collected for chemical analysis

3 2 Groundwater Samples

After the boreholes are completed to the required depth, the wells will be installed Well construction will consist of threaded, 1-inch internal diameter, Schedule 40 PVC casing and screen (Number 10 slot) and a threaded PVC bottom cap The well casing will reach 6 inches or more above the ground surface 16/40 filter sand will be poured around the PVC screen and will extend to at least 2 feet above the top of the screen The remaining well annulus will be filled with bentonite to prevent surface runoff from entering the well annulus Granular bentonite will be poured into the annular space in 2- to 3-foot increments Water will be added to swell the bentonite before the next increment is poured This process will continue to ground surface A 1 5-foot section of 2-inch internal diameter casing will be installed around the above-ground section of the well casing Granular bentonite mixed with water will be poured around the outside of the well assembly and A slip-over PVC cap will be loosely placed on the well casing and a threaded PVC cap will be placed on the 2-inch diameter protective casing

The water level in the well will be measured after well completion according to GW 01 Water Level Measurements in Wells and Piezometers The well will be allowed to recover overnight, and, if sufficient water is present (estimated as at least 1 foot of standing water), a sample will be collected using the methods specified in GW 06 Groundwater Sampling the following day The water level will be measured prior to and after collection of the groundwater sample All water level measurements will be recorded in the project logbooks Quarterly groundwater samples will be collected at six to ten of the wells in the SPP area for two additional quarters These wells may be part of this additional sampling program

4 0 DATA MANAGEMENT

A field logbook will be created and maintained for the project by the project manager or her designee in accordance with ER-ADM-05 14 Use of Field Logbooks and Forms The logbook will be used in conjunction with the appropriate field data forms required by the operating procedures (Table 3) governing the field activities occurring during this project It is not necessary to duplicate items recorded on field data forms in the field notebook, but if additional clarification of entries on the forms is required they should be recorded in the field notebook The field notebook should include time and date information concerning the field activities and a sketch map of actual sample locations Information not specifically required by the field data forms should be recorded in the field notebook

Data for this project will be collected, entered, and stored in a secure, controlled, and retrievable environment in accordance with 2-G18-ER-ADM-17 01 Records Capture and Transmittal

4.1 Project Completion

The results of the each sampling event will be compiled into a data summary report with a map showing well locations The results of the sampling events will help define the nature and extent of the SPP and will be used by the hydrogeology and phytoremediation subcontractors to evaluate the three retained remedial alternatives for the SPP (RMRS/RTG 1997) Data interpretation will be conducted by the hydrogeology subcontractor and will be summarized in the Decision Document by RMRS

4.2 Quality Assurance

Analytical data collected in support of this investigation will be evaluated using the guidance established by the Rocky Flats Administrative Procedure 2-G32-ER-ADM-08 02 Evaluation of ERM Data for Usability in Final Reports This procedure establishes the guidelines for evaluating analytical data with respect to precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters

Precision for this project will be evaluated by calculating the relative percent difference between samples and duplicates (30% will be used for an acceptable RPD) and laboratory and field replicates will be analyzed at a rate of 1 in 20 Accuracy for the project will be evaluated by analyzing Laboratory Control Samples, method blanks and equipment blanks at a rate of 1 in 20 Representativeness will be ensured by following the applicable approved sampling procedures and workplans and ensuring that the chains of custody are properly completed Comparability of historical and new data will be ensured by use of the same analytical methods and by documenting/referencing all analytical procedures Completeness will be evaluated by comparing the proposed to the actual field program The target for completeness for the project is 90%

One hundred percent (100%) of the electronic data will be verified for holding times, relative percent difference, etc (25% of the hard copy data will be validated)

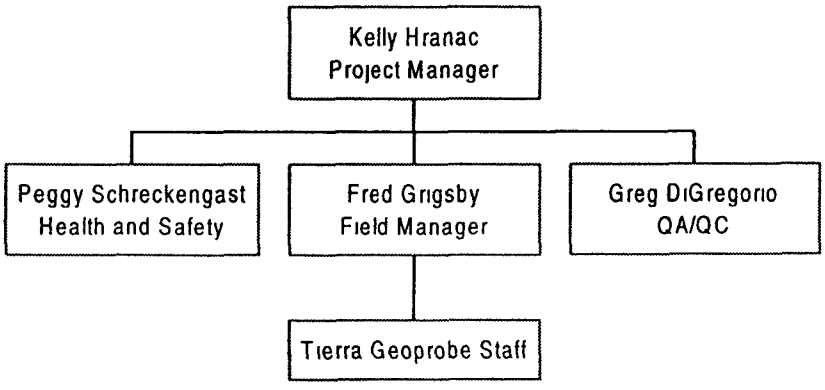
Table 3 Applicable Field and Administrative Standard Operating Procedures

Procedure Number	Procedure Title
2-G18-ER-ADM-17 01	Records Capture and Transmittal
2-G32-ER-ADM-08 02	Evaluation of ERM Data for Usability in Final Reports
2-S47-ER-ADM-05 14	Use of Field Logbooks and Forms
5-21000-OPS-FO 3	General Equipment Decontamination
5-21000-OPS-FO 6	Handling of Personal Protective Equipment
5-21000-OPS-FO 7	Handling of Decontaminated Water and Waste Water
5-21000-OPS-FO 10	Receiving, Labeling, and Handling Environmental Material Containers
5-21000-OPS-FO 11	Field Communications
5-21000-OPS-FO 13	Containerization, Preserving, Handling and Shipping of Soil and Water
5-21000-OPS-FO 15	Photoionization Detectors and Flame Ionization Detectors
5-21000-OPS-FO 16	Field Radiological Measurements
5-21000-ER-OPS-GT 01	Logging Alluvial and Bedrock Material
5-21000-ER-OPS-GT 06	Monitoring Wells and Piezometer Installation
5-21000-ER-OPS-GW 01	Water Level Measurements in Wells and Piezometers
5-21000-ER-OPS-GW 06	Groundwater Sampling

5 0 PROJECT ORGANIZATION

The project organization chart is presented in Figure 3 The ER Projects Group is responsible for management and coordination of resources dedicated to the project Other organizations assisting with the implementation of this project are RMRS Groundwater, RMRS Health and Safety, and RMRS Quality Assurance

Figure 3 Solar Ponds Plume Characterization



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7.0 LIST OF ACRONYMS

DOE	Department of Energy
DQO	Data Quality Objective
EPA	Environmental Protection Agency
ER	Environmental Restoration
GPS	Global Positioning System
IHSS	Individual Hazardous Substance Site
IM/IRA	Interim Measure/Interim Remedial Action
MCLs	Maximum Contaminant Levels
OU	Operable Unit
QA/QC	Quality Assurance/Quality Control
QAPD	Quality Assurance Program Description
RFCA	Rocky Flats Cleanup Agreement
RFETS	Rocky Flats Environmental Technology Site
RMRS	Rocky Mountain Remediation Services
SAP	Sampling and Analysis Plan
SPP	Solar Ponds Plume
UHSU	Upper Hydrostratigraphic Unit
VOCs	Volatile organic compounds

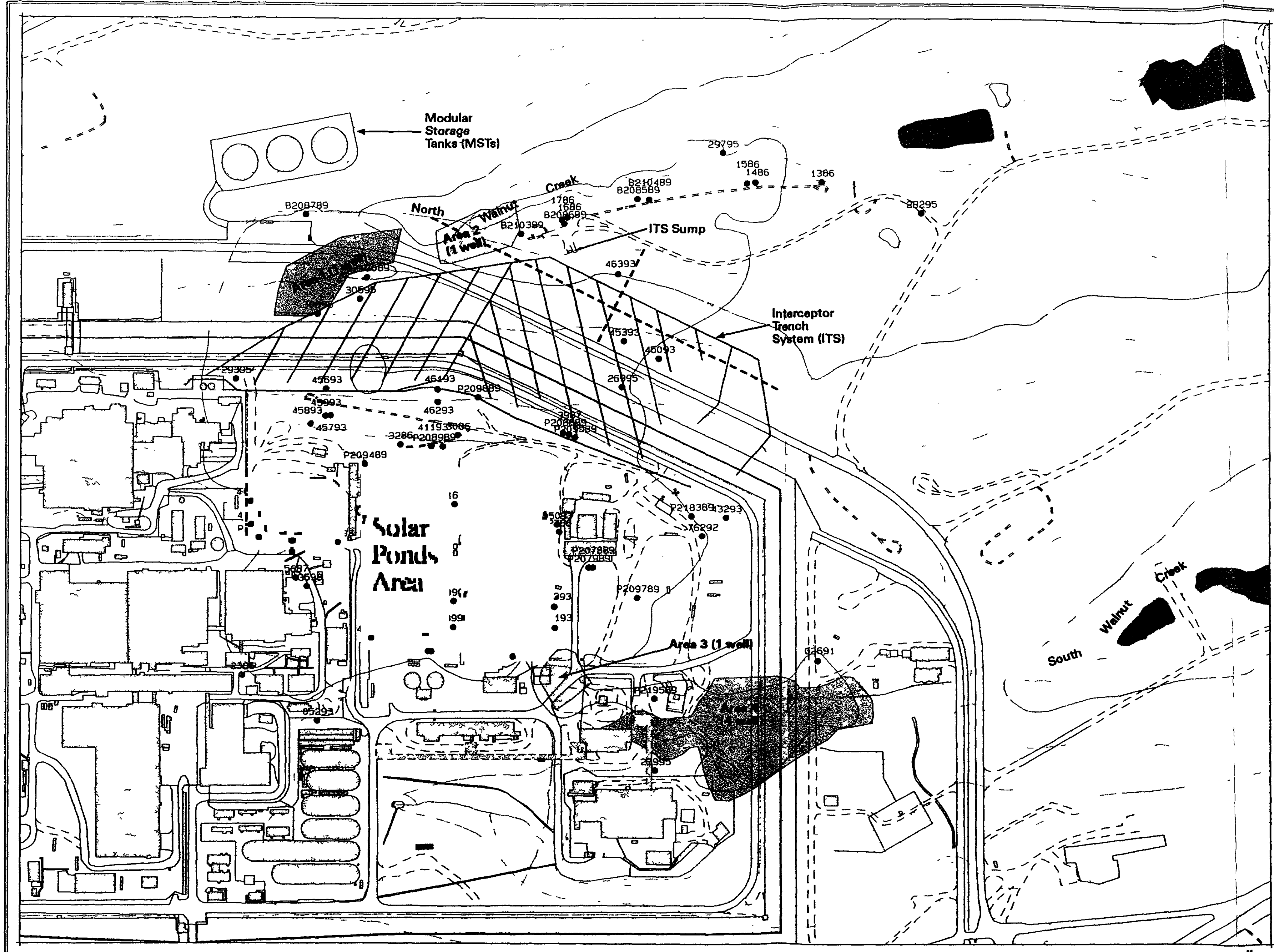

Figure 2

Groundwater Well Location Map

Solar Evaporation Ponds Area and Vicinity

EXPLANATION

- Transects for Collection of Soil Sample
- LHSU Bedrock Monitoring Well
- UHSU Bedrock Monitoring Well
- Bedrock/Alluvium Monitoring Well
- Alluvium Monitoring Well
- General Locations of New Weathered Bedrock Geoprobe Well
- General Locations of New Alluvium Geoprobe Well (if water present during drilling)
- Approximate Extent of SPP Nitrate Plume (MCL)

Standard Map Features

- Buildings nd other structure
- Solar evaporation ponds
- Lake nd pond
- Streams, ditches, or other drainage feature
- Fence nd the b mer
- Contour (20-Foot)
- Paved road
- Dirt roads

Scale 1 3860
1 inch represents approximately 322 feet

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U S Department of Energy
Rocky Flats Environmental Technology Site

Prepared by

RMRS Rocky Mountain Remediation Services, L.L.C.

MAP ID: 98-0037

December 22, 1997

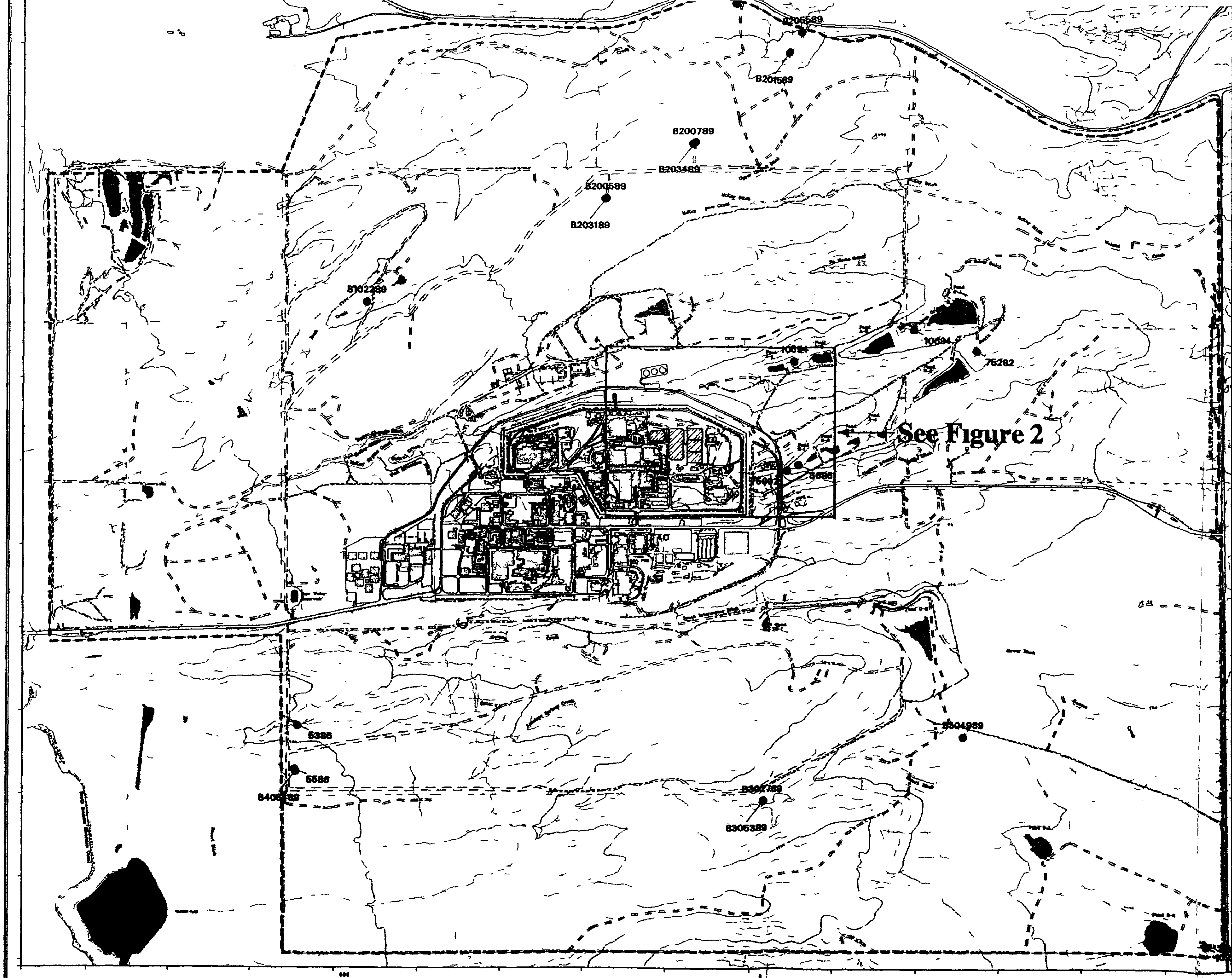

Figure 1

Groundwater Well Location Map

EXPLANATION

Legend

- ● UHSU Bedrock Monitori g Well
- ● Alluvi m Monit g Well

Standard Map Features

- Buildings and other st uctures
- Solar evaporatio pond
- Lakes and po d
- Streams, ditches, r other drai age features
- Fences and other bar ier
- Contour (20-Foot)
- Rocky Flat boundary
- Paved roads
- Dirt road

Scale = 1 20450
1 inch represents approximately 1704 feet

500 0 1000 2000ft

State Plane Coordinate Projectio
Colorado Central Zone
Datum. NAD27

U S Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:

RMRS Rocky Mountain Remediation Services, L.L.C

MAP ID: MK

December 29, 1997